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## HEAT AS AN INSECTICIDE IN THE HERBARIUM


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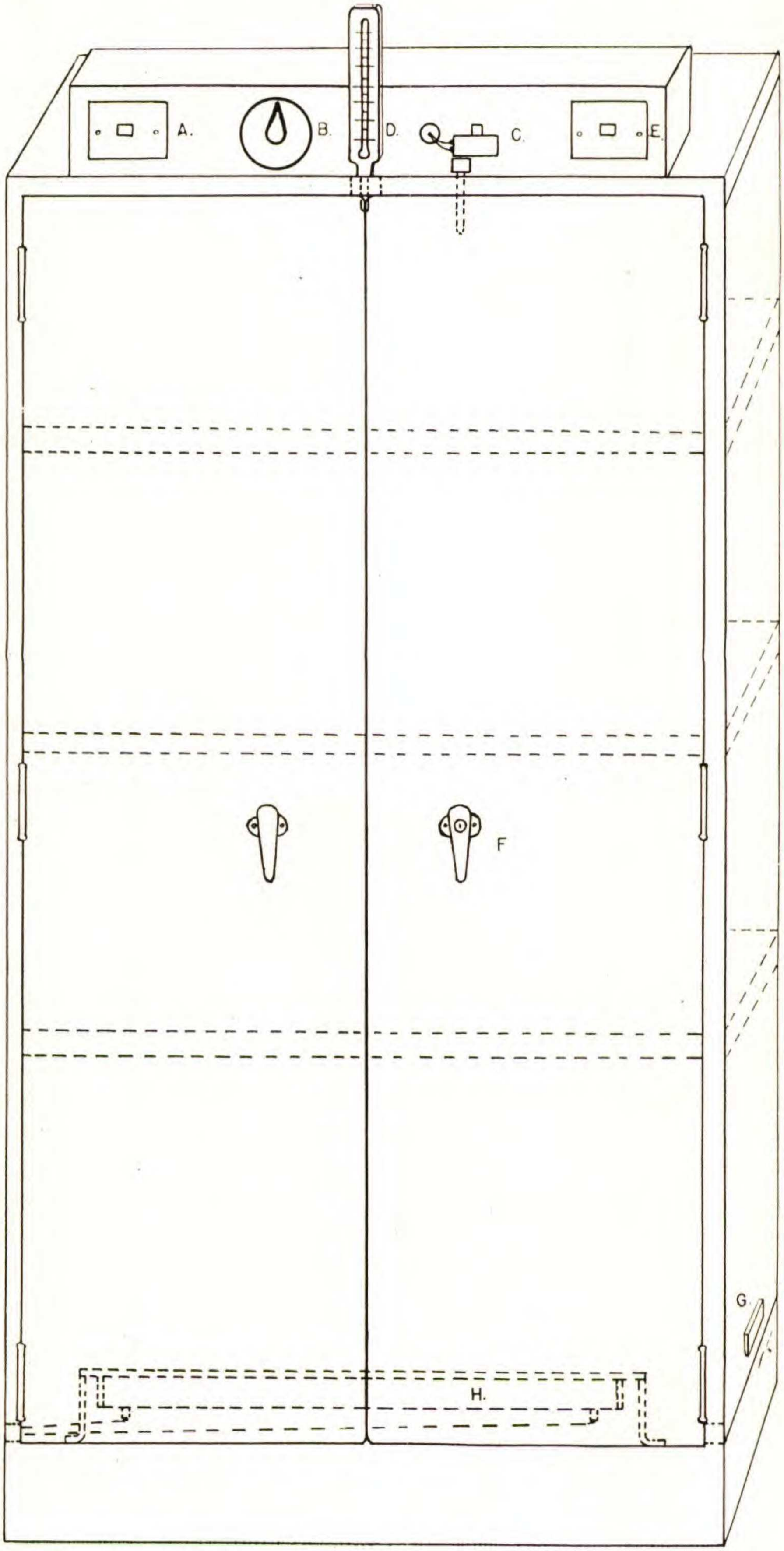
Insect pests in plant collections are controlled (a) by poisoning the specimens; (b) by periodical fumigation; (c) by the use of repellants; (d) by some combination of these three methods.

In "La Conservazione degli Erbari e l'efficacia del Sublimato ($Hg\ Cl_2$) nell' avvelamento delle piante," Passerini and Pampini[1] discuss the relative efficiency of various poisons and fumigants. All poisons are objectionable in that they are poisonous to the botanist as well as to the insect. Fumigants are objectionable because they are either poisonous to man, or explosive or have disagreeable odors. Repellants are efficient only when used in conjunction with some insecticide. All of these methods kill the eggs of insects only after relatively long periods of time. If the eggs are in fruits, such as acorns or haws, they are usually not killed by any of these methods.

Insects are killed by heat at comparatively low temperatures, e. g. the Mediterranean Fruit Fly (*Ceratites capitata*) is killed in ten hours in any stage (egg as well as larva or pupa) by a temperature of 110° F or 43° C. Museum beetles (*Dermestes*), weevils, roaches, tripetids in acorns, gall-worms in stems were found by the author to succumb as easily to mild temperatures. These tests were made in a steel case designed by the writer and figured herewith. The case is of the same style, finish and construction as the steel cabinets in this herbarium (i. e. substantially the same as those in use in the Gray Herbarium) except that the walls and the doors are of double layers of sheet steel with asbestos filling between the layers. The insulation greatly re-

[1] Soc. Bot. Ital. (Firenze) Nuova Serie Vol. 34. (1927).


A.
B.
D.
C.
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duces loss of heat by radiation through the walls and doors and also makes the apparatus fireproof according to the Underwriters' inspection.

In order to preclude the remotest possible chance of plants taking fire, specimens are never placed on the lowest shelf. On this lowest shelf may be placed a pan of water to prevent excessive drying of specimens.

On account of the low conductivity of the sheets of paper and of the plants themselves, the transfer of heat from the outside of a bundle of plants to the inside takes place very slowly. In practice this may be overcome safely by using a temperature of about 170° F or 77° C. In about 4 to 6 hours this will raise the temperature in the inside of a bundle of plants to about 140° F (60° C), a temperature sufficient to kill insects in any stage in a few minutes without damaging the plant specimens in any way. In fact, in drying plants between corrugated cardboard and blotters, as ordinarily practiced in the tropics, the plants are often subjected to considerably higher temperatures. It is believed that this method of killing insects is more thorough and more rapid and less expensive than any known method. In contrast to the commonly used insecticides it is: (a) Not poisonous (as are hydrogen cyanide, mercury bichloride, sodium arsenite, carbon bisulfide, sulphur dioxide); (b) Not explosive (as are hydrogen cyanide, carbon bisulfide); (c) It really kills all eggs of insects in large fruits in a few hours.

A vent in the roof of the cabinet and a vent in either wall (G) near the floor converts the heat-treater into an efficient apparatus for drying plants in presses made of corrugated cardboard and blotters.

The apparatus figured here, has been used since June 1933 to treat nearly 200,000 sheets of plants as well as a collection of fungi. No insect pests have been discovered in the plants in this herbarium since that date.

The specifications of this heat-treating cabinet are as follows: Height 70 inches; Width 37 inches; Depth 24 inches. Capacity 3000 to 6000 mounted or unmounted herbarium specimens.

## Explanation of Figure

(H) Two 500-watt 110-volt space heaters connected in series paralleled with (B) a three-heat indicating switch located at top of cabinet. Each of these heaters is bolted to a 4″ x 30″ x 1/8″ plate with ¼″ asbestos board between plate and heater. Plate is supported 2″ above bottom of cabinet and placed 7″ and 15″ inside and parallel to front surfaces.

(C) Immersion type mercoid thermal cutout having a range of approximately 120–200° F. This regulator is wired in series with the supply line.

(A and E) Two candelabra base pilot receptacles containing Neon lamps behind a suitable bull's-eye, one pilot across heater elements and one across line ahead of thermal cutout and switch. This to enable operator to tell when (A) cabinet is connected to line when (E) heater is operating. Not shown on diagram is a receptacle at (I) left side of cabinet 8″ from floor to allow connection by means of a two conductor no. 14 asbestos heater cord.

Four shelves made of no. 10 wire woven in a one-inch diamond mesh and welded to a suitable frame are shown by double horizontal dotted lines.

(G) Three ventilation holes cut through cabinet one at each side near bottom and one in the top, each hole approximately 3″ x 6″ and fitted with reasonably tight covers.

(D) Thermometer indicating air temperature inside cabinet.

(F) Handles to doors.

Specifications for the electrical equipment were drawn by Mr. Robert E. Robson.

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# NOTES ON THE CLADONIAE OF CONNECTICUT—III[1]

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THE present series of notes represents the third supplement to the writer's report on the Cladoniae of Connecticut,[2] published in 1930. This report was based on collections made down to the close of 1928. The first supplement[3] brought the record down to 1931, and the second[4] to 1933. In this third supplement the record is brought down to the close of 1936. The writer has again enjoyed the kind cooperation of Dr. Heinrich Sandstede of Bad Zwischenahn, Oldenburg, in the preparation of this paper and would again extend to him his grateful thanks. Dr. Sandstede has examined the majority of the specimens listed and has commented on some of the more critical species, varieties, and forms.

The names of most of the collectors mentioned on the following pages have already appeared in the writer's earlier papers on Cladoniae. During the past three years a number of additional botanists have sent in material for study, and a few specimens of earlier date have come to light. The new names, which will be cited in connection with individual specimens, are as follows: Miss Dorothy Arnold, B. Livings-

[1] Contribution from the Osborn Botanical Laboratory.
[2] Trans. Connecticut Acad. **30**: 357–510. 1930.
[3] RHODORA **34**: 121–142, 153–164. 1932.
[4] *Ibid.* **37**: 33–57. 1935.